Amendments to the Claims

This Listing of Claims replaces all prior versions, and listings, of claims in this application.

1-429 (Cancelled).

430. (Currently Amended) An electrophoresis apparatus, comprising:

a transport passage;

a first separation passage overlapping and intersecting the transport passage at a first intersection;

the first intersection having a first staggered configuration which includes a first elongated concentration area;

a first analyte concentrator containing at least one first immobilized affinity ligand in the first elongated concentration area to concentrate a first analyte of interest from a sample introduced into the transport passage;

a second separation passage overlapping and intersecting the transport passage at a second intersection spaced downstream from the first intersection;

the second intersection having a second staggered configuration which includes a second elongated concentration area;

a second analyte concentrator containing at least one second immobilized affinity ligand in the second elongated concentration area to concentrate a second analyte of interest from the sample introduced into the transport passage;

analyte detector means for identifying and characterizing the first and second analytes of interest conveyed thereto from the first and second analyte concentrators, respectively; and

~~valve~~ controlling means for controlling flow of the sample in the transport passage and past the first and second intersections and for controlling flow of buffer fluid through the first and second separation passages and conveyed by electrophoresis migration, pressure or a combination of electrophoresis migration and pressure to the analyte detector means.

431. (Previously Presented) The electrophoresis apparatus of claim 430 wherein the first analyte concentrator includes a matrix assembly having a surface to which the first immobilized affinity ligand is bound.

432. (Previously Presented) The electrophoresis apparatus of claim 431 wherein the matrix assembly includes a plurality of microstructures.

433. (Currently Amended) The electrophoresis apparatus of claim 431 wherein the matrix assembly is free-floating, and the first analyte concentrator retains the free-floating matrix assembly ~~free-floating and non-interconnected~~ by pressure-resistant porous end walls or frits disposed in the transport passage and the first separation passage.

434. (Currently Amended) The electrophoresis apparatus of claim 431 wherein the matrix assembly includes a fixed architecture defined by beaded microstructures interconnected to each other and to an inner wall of the first ~~separation~~ passage elongated concentration area.

435. (Previously Presented) The electrophoresis apparatus of claim 431 wherein the matrix assembly includes a fixed architecture fabricated from polymeric microstructures interconnected to each other and to the first elongated concentration area.

436. (Currently Amended) The electrophoresis apparatus of claim 430 further comprising an auxiliary passage through which a cleaning ~~buffer~~ solution and a separation buffer can be introduced into the first separation passage downstream of the first analyte concentrator.

437. (Currently Amended) The electrophoresis apparatus of claim 436 wherein the auxiliary passage ~~defines~~ is an electrolyte-provider and cleaning solution-provider passage.

438. (Currently Amended) The electrophoresis apparatus of claim 430 further comprising an auxiliary passage coupled to the second separation passage

downstream of the second analyte ~~capillary~~ concentrator to provide a buffer fluid, including a cleaning solution and a separation buffer, to the second separation passage away from the second analyte concentrator.

439. (Currently Amended) The electrophoresis apparatus of claim 438 wherein ~~the auxiliary passage is controlled by~~ the ~~valve~~ controlling means controls flow in the auxiliary passage.

440. (Previously Presented) The electrophoresis apparatus of claim 430 further comprising an auxiliary analyte concentrator on the first separation passage and downstream of the first analyte concentrator, the auxiliary analyte concentrator having at least one affinity ligand capable of retaining chromophores to bind the first analyte of interest released from the first analyte concentrator to improve the sensitivity and selectivity of the first analyte of interest.

441. (Previously Presented) The electrophoresis apparatus of claim 430 wherein the first separation passage is filled with an electrically conductive fluid.

442. (Previously Presented) The electrophoresis apparatus of claim 430 wherein the first separation passage is filled with a gel matrix and an electrically conductive fluid.

443. (Currently Amended) The electrophoresis apparatus of claim 430 wherein the ~~first separation passage is filled with carrier ampholytes and other chemicals or additives to improve resolution and sensitivity and to separate eluted analytes~~ sample has a plurality of proteins with different isoelectric point levels, which are further separated through the separation passages by at least one mode of capillary electrophoresis after being subjected to isoelectric focusing in the transport passage.

444. (Previously Presented) The electrophoresis apparatus of claim 430 wherein at least one of the first and/or second immobilized affinity ligands is capable of performing at least one chemical or biochemical reaction.

445. (Currently Amended) The electrophoresis apparatus of claim 444 wherein the at least one chemical or biochemical reaction includes peptide synthesis, nucleic acid synthesis, or an enzymatic reaction.

446. (Currently Amended) The electrophoresis apparatus of claim 430 wherein at least one of the analyte concentrators has an encapsulated cellular or subcellular structure ~~for drug metabolism studies~~.

447. (Currently Amended) The electrophoresis apparatus of claim 446 wherein the encapsulated cellular or subcellular structure is adapted for drug metabolism studies and/or for ~~entity identification purposes identifying unique chemicals secreted or formed by the encapsulated cellular or subcellular structure~~ metabolic pathway studies.

448. (Currently Amended) The electrophoresis apparatus of claim 430 wherein at least one of the analyte concentrators has an acoustic micromixing system ~~positioned externally~~.

449. (Currently Amended) The electrophoresis apparatus of claim 430 wherein at least one of the analyte concentrators has a microwave pulse system ~~positioned externally~~.

450. (Previously Presented) The electrophoresis apparatus of claim 430 wherein the first immobilized affinity ligand is covalently bound to a matrix assembly of the first analyte concentrator.

451. (Currently Amended) The electrophoresis apparatus of claim 430 further comprising separation buffer fluid means for providing a separation buffer fluid to the first separation passage and downstream of the first analyte concentrator and to the second separation passage and downstream of the second analyte concentrator.

452. (Currently Amended) The electrophoresis apparatus of claim 451 wherein the ~~valve~~ controlling means controls the operation of the separation buffer fluid means.

453. (Previously Presented) The electrophoresis apparatus of claim 451 wherein the separation buffer fluid contains at least one salt.

454. (Currently Amended) The electrophoresis apparatus of claim 451 wherein the separation buffer fluid includes an organic solvent, or a mixture of organic solvents [[or]] and additives.

455. (Currently Amended) The electrophoresis apparatus of claim 430 wherein the ~~valve~~ controlling means controls the ~~operation of the sample introduction, one or more chromophoric substances, one or more~~ flow of cleaning buffers ~~and/or a number of~~ and separation ~~buffer means~~ buffers in the separation passages.

456. (Previously Presented) The electrophoresis apparatus of claim 430 further comprising a first electrolyte-provider passage in fluid communication with the first separation passage downstream of the first analyte concentrator and a second electrolyte-provider passage in fluid communication with the second separation passage downstream of the second analyte concentrator.

457. (Previously Presented) The electrophoresis apparatus of claim 430 wherein the analyte detector means is an ultraviolet detector system.

458. (Previously Presented) The electrophoresis apparatus of claim 430 wherein the analyte detector means is a fluorescence or laser-induced fluorescence detector system.

459. (Previously Presented) The electrophoresis apparatus of claim 430 wherein the analyte detector means is a conductivity, electrochemical, radioactive, mass spectrometer, circular diochroism or nuclear magnetic resonance detector system.

460. (Previously Presented) The electrophoresis apparatus of claim 430 wherein the analyte detector means includes a combination of several detectors used simultaneously.

461. (Previously Presented) The electrophoresis apparatus of claim 430 wherein the first and second separation passages merge into a single exit output passage.

462. (Currently Amended) The electrophoresis apparatus of claim 461 wherein the ~~valve~~ controlling means controls, at the merging of the first and second separation passages, sequential fluid flow from the first and second separation passages to the exit output passage.

463. (Previously Presented) The electrophoresis apparatus of claim 430 further comprising an exit outlet passage into which the first and second separation passages flow and at a detection zone of the analyte detector means.

464. (Currently Amended) The electrophoresis apparatus of claim 463 wherein the ~~valve~~ controlling means controls the sequential fluid flow of the first and second separation passages to the detection zone.

465. (Currently Amended) The electrophoresis apparatus of claim 463 ~~wherein the exit outlet passage flows into a container having an electrolyte solution and~~ further comprising a grounding electrode at an outlet end of the exit outlet passage.

466. (Currently Amended) The electrophoresis apparatus of claim 465 wherein ~~the container functions as a waste container or as a fraction collector reservoir where purified samples can be collected for chemical, biochemical or immunological tests~~ the exit outlet passage flows into a container in which the grounding electrode is positioned.

467. (Currently Amended) The electrophoresis apparatus of claim 430 wherein the first and second separation passages have separate output passages, and the analyte detector means includes a first analyte detector for the first separation passage and a separate second analyte detector for the second separation passage ~~or the analyte detector means includes a detector which is movable between the first and second separation passages~~.

468. (Currently Amended) The electrophoresis apparatus of claim ~~467~~ 430 wherein the first and second separation passages have ~~independent grounding containers or independent fraction collector reservoirs~~ separate output passages and the analyte detector means includes a detector which is movable between the first and second separation passages.

469. (Currently Amended) The electrophoresis apparatus of claim 430 ~~wherein~~ further comprising passage bulging members which retain the at least one first immobilized affinity ligand to a support matrix in the first analyte concentrator.

470. (Previously Presented) The electrophoresis apparatus of claim 430 wherein the inner diameter of the transport passage is larger than the inner diameter of the first separation passage and than the inner diameter of the second separation passage.

471. (Currently Amended) The electrophoresis apparatus of claim 430 wherein the inner diameter of the transport passage is generally the same size as the inner diameter of the first separation passage and the inner diameter of the second separation passage.

472. (Previously Presented) The electrophoresis apparatus of claim 430 wherein the transport passage and the first and second separation passages are all capillaries.

473. (Previously Presented) The electrophoresis apparatus of claim 430 wherein the transport passage and the first and second separation passages are all channels.

474. (Previously Presented) The electrophoresis apparatus of claim 430 wherein the electrophoresis apparatus is a capillary electrophoresis apparatus .

475. (Previously Presented) The electrophoresis apparatus of claim 430 wherein the electrophoresis apparatus is a microchip electrophoresis apparatus.

476. (Previously Presented) The electrophoresis apparatus of claim 430 wherein the first immobilized affinity ligands are covalently linked to an inner wall of the first staggered configuration.

477. (Currently Amended) The electrophoresis apparatus of claim 430 wherein the ~~valve~~ controlling means includes transport passage valves and separation passage valves, and wherein the transport passage valves are adapted to be opened and the first separation passage valves are adapted to be closed to allow fluid to pass through the first analyte concentrator towards an outlet end of the transport passage.

478. (Previously Presented) The electrophoresis apparatus of claim 477 wherein the fluid is the sample, at least one chromophoric substance, and at least one cleaning buffer.

479. (Currently Amended) The electrophoresis apparatus of claim 430 wherein the ~~valve~~ controlling means includes transport passage valves and first separation passage valves, and wherein the transport passage valves are adapted to be closed and the first separation passage valves are adapted to be opened to allow a separation buffer solution to pass through the first analyte concentrator and in the first separation passage to the analyte detector means.

480. (Previously Presented) The electrophoresis apparatus of claim 430 wherein one of the anode or cathode sides of the electrophoresis apparatus is generally at an inlet end of the separation passages and the other is downstream of the analyte concentrators.

481. (Currently Amended) The electrophoresis apparatus of claim 430 wherein an inlet end of the first separation passage is alternatively in fluid communication with a ~~sample supply or a separation buffer supply or an eluting buffer supply~~ or a cleaning solution supply, or an eluting buffer supply or a separation buffer supply.

482. (Previously Presented) The electrophoresis apparatus of claim 430 wherein the passages are fused-silica or plastic tubes or glass or plastic channels.

483. (Currently Amended) The electrophoresis apparatus of claim 430 ~~wherein~~ further comprising a buffer supply for the first separation passage and which includes a

separation buffer and an eluting buffer to release the bound first analyte of interest from the at least one first immobilized affinity ~~ligands~~ ligand.

484. (Currently Amended) The electrophoresis apparatus of claim 430 wherein the ~~valve~~ controlling means include valves on the transport passage on opposite sides of the first analyte concentrator and valves on the first separation passage on opposite sides of the first analyte concentrator.

485. (Previously Presented) The electrophoresis apparatus of claim 430 wherein the first separation passage is positioned and capable of separating therein the first analyte of interest retained by the first immobilized affinity ligand after the first analyte is released from the first immobilized affinity ligand and of separating the released first analyte by at least one mode of capillary electrophoresis.

486. (Previously Presented) The electrophoresis apparatus of claim 430 wherein the first immobilized affinity ligand is adapted to bind to a corresponding affinity target for concentration.

487. (Previously Presented) The electrophoresis apparatus of claim 430 wherein the first immobilized affinity ligand is adapted to bind to a corresponding affinity target for a chemical or biochemical microreaction.

488. (Currently Amended) The electrophoresis apparatus of claim 430 further comprising an analyte concentrator containing at least one immobilized specific or non-specific affinity ligand in the transport passage and upstream of the first intersection and a valve operatively between the analyte concentrator and the first intersection.

489. (Previously Presented) The electrophoresis apparatus of claim 430 wherein the analyte detector means includes one or more first analyte detectors for the first separation passage and one or more second analyte detectors for the second separation passage.

490. (Currently Amended) The electrophoresis apparatus of claim 430 wherein ~~the transport passage transports one or more chromophoric or tagging substances into the first and second analyte concentrators after the analytes of interest are captured by the first and second immobilized affinity ligands, and the valve controlling means allows an elution buffer to then be introduced in inlet ends of the first and second separation passages and through the first and second analyte concentrators~~ at least one of the separation passages transports analytes tagged with a chromophoric agent to the analyte detector means.

491. (Currently Amended) The electrophoresis apparatus of claim 430 wherein the first elongated concentration area is aligned with the first separation passage and is substantially perpendicular to the transport passage.

492. (Currently Amended) The electrophoresis apparatus of claim 430 wherein the first elongated concentration area is aligned with the transport passage and is substantially perpendicular to the first separation passage.

493. (Previously Presented) An electrophoresis apparatus, comprising:

a transport passage;

a first analyte concentrator including one or more first immobilized affinity ligands which are attracted to a first analyte of interest;

a first separation passage to convey by electrophoresis migration and/or pressure the first analyte of interest from a sample transported in the transport passage and concentrated by the first analyte concentrator at a first location of the transport passage to a detector system which identifies and characterizes the first analyte of interest;

the transport passage and the first separation passage defining a first staggered configuration at the first location and having a first elongated section in which the first analyte concentrator is positioned;

the first separation passage being communicable upstream of the first staggered configuration with a buffer supply;

a second analyte concentrator including one or more second immobilized affinity ligands which are attracted to a second analyte of interest;

a second separation passage to convey by electrophoresis migration and/or pressure the second analyte of interest from the sample transported in the transport passage and concentrated by the second analyte concentrator at a second location of the transport passage to the detector system which also identifies and characterizes the second analyte of interest;

the transport passage and the second separation passage defining a second staggered configuration at the second location and having a second elongated section in which the second analyte concentrator is positioned;

the second separation passage being communicable upstream of the second staggered configuration with a buffer supply; and

a valve system to control fluid flow in the transport passage and the separation passages.

494. (Previously Presented) The electrophoresis apparatus of claim 493 wherein the sample is transported by at least one of electrophoretic migration, pressure and vacuum in the transport passage.

495. (Previously Presented) The electrophoresis apparatus of claim 493 wherein the first analyte concentrator includes immobilized affinity ligands which are attached covalently to the inner wall of the first elongated section for attracting an affinity target.

496. (Previously Presented) The electrophoresis apparatus of claim 493 wherein the first analyte concentrator includes immobilized affinity ligands which are attached covalently to polymeric materials or beads located within the first elongated section for attracting an affinity target.

497. (Currently Amended) The electrophoresis apparatus of claim 493 wherein the first immobilized affinity ligands bind a complementary affinity target ~~through more than one chemical bond in a reversible manner~~.

498. (Previously Presented) The electrophoresis apparatus of claim 493 wherein the first analyte concentrator includes a matrix assembly having a surface to which the first immobilized affinity ligands are bound.

499. (Previously Presented) The electrophoresis apparatus of claim 498 wherein the matrix assembly includes a plurality of microstructures.

500. (Currently Amended) The electrophoresis apparatus of claim 498 wherein the matrix assembly is free-floating and the first analyte concentrator retains the free-floating matrix assembly ~~free-floating and non-interconnected~~ by pressure-resistant porous end walls disposed in the transport passage and the first separation passage.

501. (Currently Amended) The electrophoresis apparatus of claim 498 wherein the matrix assembly includes a fixed architecture defined by beaded microstructures interconnected to each other and to an inner wall of the first ~~separation passage~~ elongated section.

502. (Previously Presented) The electrophoresis apparatus of claim 498 wherein the matrix assembly includes a fixed architecture fabricated from polymeric microstructures interconnected to each other and to the first elongated section.

503. (Previously Presented) The electrophoresis apparatus of claim 493 further comprising an auxiliary passage through which a cleaning buffer and a separation buffer can be introduced into the first separation passage downstream of the first analyte concentrator.

504. (Currently Amended) The electrophoresis apparatus of claim 493 wherein the auxiliary passage ~~defines~~ is an electrolyte-provider and cleaning solution-provider passage.

505. (Previously Presented) The electrophoresis apparatus of claim 493 further comprising an auxiliary passage coupled to the second separation passage

downstream of the second analyte capillary to provide a fluid to the second separation passage away from the second analyte concentrator.

506. (Currently Amended) The electrophoresis apparatus of claim 505 wherein flow in the auxiliary passage is controlled by the valve system.

507. (Previously Presented) The electrophoresis apparatus of claim 493 further comprising an auxiliary analyte concentrator on the first separation passage and downstream of the first analyte concentrator, the auxiliary analyte concentrator having affinity ligands capable of retaining chromophores to bind the first analyte of interest released from the first analyte concentrator to improve the sensitivity and selectivity of the first analyte of interest.

508. (Previously Presented) The electrophoresis apparatus of claim 493 wherein the first separation passage is filled with an electrically conductive fluid.

509. (Previously Presented) The electrophoresis apparatus of claim 493 wherein the first separation passage is filled with a gel matrix and an electrically conductive fluid.

510. (Currently Amended) The electrophoresis apparatus of claim 493 wherein the ~~first separation passage is filled with carrier ampholytes and other chemicals or additives to improve resolution and sensitivity and to separate eluted analytes~~ sample has a plurality of proteins with different isoelectric point levels, which are further separated through the separation passage by at least one mode of capillary electrophoresis after being subjected to isoelectric focusing in the transport passage.

511. (Previously Presented) The electrophoresis apparatus of claim 493 wherein the first and/or second immobilized affinity ligands are capable of performing at least one chemical or biochemical reaction.

512. (Currently Amended) The electrophoresis apparatus of claim 511 wherein the reaction includes peptide synthesis, nucleic acid synthesis or an enzymatic reaction.

513. (Previously Presented) The electrophoresis apparatus of claim 493 wherein at least one of the analyte concentrators has an encapsulated cellular or subcellular structure adapted for drug metabolism studies.

514. (Currently Amended) The electrophoresis apparatus of claim 493 wherein at least one of the analyte concentrators has an ~~external~~ acoustic micromixing system.

515. (Currently Amended) The electrophoresis apparatus of claim 493 wherein at least one of the analyte concentrators has ~~an external~~ a microwave pulse system.

516. (Previously Presented) The electrophoresis apparatus of claim 493 wherein the first immobilized affinity ligands are covalently bound to a matrix assembly of the first analyte concentrator.

517. (Currently Amended) The electrophoresis apparatus of claim 493 further comprising separation buffer fluid means for providing a separation buffer fluid to the first separation passage and downstream of the first analyte concentrator and to the second separation passage and downstream of the second analyte concentrator.

518. (Currently Amended) The electrophoresis apparatus of claim 517 wherein the valve system controls the operation of the separation buffer fluid means.

519. (Currently Amended) The electrophoresis apparatus of claim 517 wherein the separation buffer fluid includes an organic solvent, or a mixture of organic solvents [[or]] and additives.

520. (Previously Presented) The electrophoresis apparatus of claim 517 wherein the separation buffer fluid contains at least one salt.

521. (Previously Presented) The electrophoresis apparatus of claim 493 further comprising a first electrolyte-provider passage in fluid communication with the first separation passage and downstream of the first analyte concentrator and a second electrolyte-provider passage in fluid communication with the second separation passage and downstream of the second analyte concentrator.

522. (Previously Presented) The electrophoresis apparatus of claim 493 wherein the detector system is an ultraviolet detector system.

523. (Previously Presented) The electrophoresis apparatus of claim 493 wherein the detector system is a fluorescence or laser-induced fluorescence detector system.

524. (Previously Presented) The electrophoresis apparatus of claim 493 wherein the detector system is a conductivity, electrochemical, radioactive, mass spectrometer, circular diochroism or nuclear magnetic resonance detector system or a combination of several detectors used simultaneously.

525. (Currently Amended) The electrophoresis apparatus of claim 493 wherein the first and second separation passages merge into a single exit ~~output~~ outlet passage.

526. (Currently Amended) The electrophoresis apparatus of claim 525 wherein the valve system controls, at the merging of the first and second separation passages, [[the]] sequential fluid flow from the first and second separation passages to the exit ~~output~~ outlet passage.

527. (Currently Amended) The electrophoresis apparatus of claim 525 ~~wherein the exit outlet passage flows into a container having an electrolyte solution and~~ further comprising a grounding electrode at an outlet end of the exit outlet passage.

528. (Currently Amended) The electrophoresis apparatus of claim 527 wherein the ~~container functions as a waste container or as a fraction collector reservoir where purified samples can be collected for chemical, biochemical or immunological tests~~ exit outlet passage flows into a container in which the grounding electrode is positioned.

529. (Previously Presented) The electrophoresis apparatus of claim 493 further comprising an exit outlet passage into which the first and second separation passages flow and at a detection zone of the detector system.

530. (Previously Presented) The electrophoresis apparatus of claim 529 wherein the valve system controls sequential fluid flow of the first and second separation passages to the exit output passage and the detection zone.

531. (Currently Amended) The electrophoresis apparatus of claim 493 further comprising ~~wherein~~ passage bulging members which retain the first immobilized affinity ligands in the first analyte concentrator.

532. (Previously Presented) The electrophoresis apparatus of claim 493 wherein the inner diameter of the transport passage is larger than the inner diameter of the first separation passage and than the inner diameter of the second separation passage.

533. (Currently Amended) The electrophoresis apparatus of claim 493 wherein the inner diameter of the transport passage is generally the same size as the inner diameter of the first separation passage and the inner diameter of the second separation passage.

534. (Previously Presented) The electrophoresis apparatus of claim 493 wherein the transport passage and the first and second separation passages are all capillaries.

535. (Previously Presented) The electrophoresis apparatus of claim 493 wherein the transport passage and the first and second separation passages are all channels.

536. (Previously Presented) The electrophoresis apparatus of claim 493 wherein the electrophoresis apparatus is a capillary electrophoresis apparatus.

537. (Previously Presented) The electrophoresis apparatus of claim 493 wherein the electrophoresis apparatus is a microchip electrophoresis apparatus.

538. (Previously Presented) The electrophoresis apparatus of claim 493 wherein the first immobilized affinity ligands are covalently linked to an inner wall of the first elongated section.

539. (Previously Presented) The electrophoresis apparatus of claim 493 wherein the valve system includes transport passage valves and separation passage valves, and wherein the transport passage valves are adapted to be opened and the first separation passage valves are adapted to be closed to allow fluid to pass through the first analyte concentrator towards an outlet end of the transport passage.

540. (Previously Presented) The electrophoresis apparatus of claim 539 wherein the fluid is the sample, at least one chromophoric substance, and at least one cleaning buffer.

541. (Previously Presented) The electrophoresis apparatus of claim 493 wherein the valve system includes transport passage valves and first separation passage valves, and wherein the transport passage valves are adapted to be closed and the first separation passage valves are adapted to be opened to allow a separation buffer solution to pass through the first analyte concentrator and in the first separation passage to the detector system.

542. (Currently Amended) The electrophoresis apparatus of claim 493 wherein one of the anode or cathode sides of the electrophoresis apparatus is at the buffer supply and the other of the sides is downstream of the analyte concentrators.

543. (Currently Amended) The electrophoresis apparatus of claim 493 wherein an inlet end of the separation passage is alternatively in fluid communication with ~~the sample supply or a separation buffer supply or an eluting buffer supply or~~ a cleaning solution supply or an eluting buffer supply or a separation buffer supply.

544. (Previously Presented) The electrophoresis apparatus of claim 493 wherein the passages are fused-silica or plastic tubes or channels.

545. (Previously Presented) The electrophoresis apparatus of claim 493 wherein the buffer supply of the first separation passage includes a separation buffer and an eluting buffer to release the bound first analyte of interest from the first immobilized affinity ligands.

546. (Previously Presented) The electrophoresis apparatus of claim 493 wherein the valve system include valves on the transport passage on opposite sides of the first analyte concentrator and valves on the separation passage on opposite sides of the first analyte concentrator.

547. (Previously Presented) The electrophoresis apparatus of claim 493 wherein the first separation passage is positioned and capable of separating therein the first analyte of interest retained by the first immobilized affinity ligands after the first analyte is released from the first immobilized affinity ligands and of separating the released first analyte by at least one mode of capillary electrophoresis.

548. (Currently Amended) The electrophoresis apparatus of claim 493 further comprising an analyte concentrator containing at least one specific or non-specific analyte positioned upstream of the first intersection.

549. (Currently Amended) The electrophoresis apparatus of claim 493 wherein the at least one first immobilized affinity ligands [[are]] is oriented ~~in a direction~~ to facilitate ~~optimization of reversible~~ binding between the first immobilized affinity ligands and an affinity target.

550. (Currently Amended) The electrophoresis apparatus of claim 493 wherein the first immobilized affinity ligands are oriented in a direction to ~~facilitate maximization of~~ increase surface area to increase capacity to capture ~~a large amount of~~ an affinity target.

551. (Previously Presented) An electrophoresis apparatus, comprising:

a transport passage;

a first analyte concentrator which is a first analyte concentrator-microreactor adapted to concentrate a first analyte of interest;

a first separation passage to convey by electrophoresis migration and/or pressure the first analyte of interest from a sample transported in the transport passage and concentrated by one or more first immobilized affinity ligands in the first analyte

concentrator-microreactor at a first location of the transport passage to a detector system which identifies and characterizes the first analyte of interest;

the first separation passage being positionable in fluid communication at an inlet end thereof with a buffer supply;

the transport passage and the first separation passage defining a first staggered configuration at the first location and having a first elongated portion in which the first analyte concentrator-microreactor is positioned;

a second analyte concentrator which is a second analyte concentrator-microreactor adapted to concentrate a second analyte of interest;

a second separation passage to convey by electrophoresis migration and/or pressure the second analyte of interest from the sample and concentrated by one or more second immobilized affinity ligands in the second analyte concentrator-microreactor at a second location of the transport passage to the detector system which also identifies and characterizes the second analyte of interest;

the second separation passage being positionable in fluid communication at an inlet end thereof with a buffer supply;

the transport passage and the second separation passage defining a second staggered configuration at the second location and having a second elongated portion in which the second analyte concentrator-microreactor is positioned; and

a valve system to control fluid flow in the passages, the valve system including valves on the first separation passage and the transport passage and operatively around the first staggered configuration and valves on the second separation passage and the transport passage and operatively around the second staggered configuration.

552. (Previously Presented) The electrophoresis apparatus of claim 551 wherein the sample is transported by electrophoretic migration, pressure and/or vacuum into the transport passage.

553. (Previously Presented) The electrophoresis apparatus of claim 551 wherein the first analyte concentrator-microreactor comprises a site for chemical synthesis.

554. (Currently Amended) The electrophoresis apparatus of claim 553 wherein the chemical synthesis is peptide synthesis or nucleic acid synthesis.

555. (Previously Presented) The electrophoresis apparatus of claim 551 wherein the first concentrator-microreactor includes a matrix assembly having a surface to which the first immobilized affinity ligands are bound.

556. (Previously Presented) The electrophoresis apparatus of claim 555 wherein the matrix assembly includes a plurality of microstructures.

557. (Currently Amended) The electrophoresis apparatus of claim 555 wherein the matrix assembly is free-floating and the first concentrator-microreactor retains the free-floating matrix assembly ~~free-floating and non-interconnected~~ by pressure-resistant porous end walls or frits disposed in the transport passage and the first separation passage.

558. (Previously Presented) The electrophoresis apparatus of claim 555 wherein the matrix assembly includes a fixed architecture defined by beaded microstructures interconnected to each other and to an inner wall of the first separation passage.

559. (Previously Presented) The electrophoresis apparatus of claim 555 wherein the matrix assembly includes a fixed architecture fabricated from polymeric microstructures interconnected to each other and to an inner wall of the first elongated portion.

560. (Previously Presented) The electrophoresis apparatus of claim 551 further comprising an auxiliary passage through which a cleaning buffer and a separation buffer can be introduced into the first separation passage and downstream of the first analyte concentrator-microreactor.

561. (Currently Amended) The electrophoresis apparatus of claim 560 wherein the auxiliary passage defines is an electrolyte-provider and a cleaning solution-provider passage.

562. (Previously Presented) The electrophoresis apparatus of claim 551 further comprising an auxiliary passage coupled to the first separation passage downstream of the first analyte concentrator-microreactor to provide a fluid to the first separation passage away from the first analyte concentrator-microreactor.

563. (Previously Presented) The electrophoresis apparatus of claim 562 wherein the auxiliary passage is controlled by the valve system.

564. (Previously Presented) The electrophoresis apparatus of claim 551 further comprising an auxiliary analyte concentrator on the first separation passage and downstream of the first analyte concentrator-microreactor, the auxiliary analyte concentrator having affinity ligands capable of retaining chromophores to bind the first analyte of interest released from the first analyte concentrator-microreactor to improve the sensitivity and selectivity of the first analyte of interest.

565. (Previously Presented) The electrophoresis apparatus of claim 551 wherein the first separation passage is filled with an electrically conductive fluid.

566. (Previously Presented) The electrophoresis apparatus of claim 551 wherein the first separation passage is filled with a gel matrix and an electrically conductive fluid.

567. (Currently Amended) The electrophoresis apparatus of claim 551 wherein the ~~first separation passage is filled with carrier ampholytes and other chemicals or additives to improve resolution and sensitivity and to separate eluted analytes~~ sample has a plurality of proteins with different isoelectric point levels, which are further separated through the separation passages by at least one mode of capillary electrophoresis after being subjected to isoelectric focusing in the transport passage.

568. (Previously Presented) The electrophoresis apparatus of claim 551 wherein the first and/or second immobilized affinity ligands are capable of performing at least one chemical or biochemical reaction.

569. (Currently Amended) The electrophoresis apparatus of claim 568 wherein the reaction is peptide synthesis, nucleic acid synthesis, or an enzymatic reaction

570. (Previously Presented) The electrophoresis apparatus of claim 551 wherein the first and/or second analyte concentrator-microreactors have an encapsulated cellular or subcellular structure.

571. (Currently Amended) The electrophoresis apparatus of claim 570 wherein the encapsulated cellular or subcellular structure is adapted for drug metabolism studies and/or for ~~entity identification purposes identifying unique chemicals secreted or formed by the encapsulated cellular or subcellular structure~~ metabolic pathway studies.

572. (Currently Amended) The electrophoresis apparatus of claim 551 wherein the first and/or second analyte concentrator-microreactors have an acoustic micromixing system ~~positioned externally~~.

573. (Currently Amended) The electrophoresis apparatus of claim 551 wherein the first and/or second analyte concentrator-microreactors have a microwave pulse system ~~positioned externally~~.

574. (Previously Presented) The electrophoresis apparatus of claim 551 wherein first immobilized affinity ligands are covalently bound to a matrix assembly of the first concentrator-microreactor.

575. (Currently Amended) The electrophoresis apparatus of claim 551 further comprising separation buffer fluid means for providing a separation buffer fluid to the first separation passage and downstream of the first analyte concentrator-microreactor and to the second separation passage and downstream of the second analyte concentrator-microreactor.

576. (Currently Amended) The electrophoresis apparatus of claim 575 wherein the valve system controls the operation of the separation buffer fluid means.

577. (Previously Presented) The electrophoresis apparatus of claim 575 wherein the separation buffer fluid includes an organic solvent, or a mixture of organic solvents or additives.

578. (Previously Presented) The electrophoresis apparatus of claim 575 wherein the separation buffer fluid contains at least one salt.

579. (Previously Presented) The electrophoresis apparatus of claim 551 further comprising a first electrolyte-provider passage in fluid communication with the first separation passage and downstream of the first analyte concentrator-microreactor and a second electrolyte-provider passage in fluid communication with the second separation passage and downstream of the second analyte concentrator-microreactor.

580. (Previously Presented) The electrophoresis apparatus of claim 551 wherein the detector system is an ultraviolet detector system.

581. (Previously Presented) The electrophoresis apparatus of claim 551 wherein the detector system is a fluorescence or laser-induced fluorescence detector system.

582. (Previously Presented) The electrophoresis apparatus of claim 551 wherein the detector system is a conductivity, electrochemical, radioactive, mass spectrometer, circular diochroism or nuclear magnetic resonance detector system.

583. (Previously Presented) The electrophoresis apparatus of claim 551 wherein the first and second separation passages merge into a single exit output passage.

584. (Previously Presented) The electrophoresis apparatus of claim 583 wherein the valve system controls, at the merging of the first and second separation passages, sequential fluid flow from the first and second separation passages to the exit output passage.

585. (Previously Presented) The electrophoresis apparatus of claim 551 further comprising an exit outlet passage into which the first and second separation passages flow and at a detection zone of the detector system.

586. (Previously Presented) The electrophoresis apparatus of claim 585 wherein the valve system controls sequential fluid flow of the first and second separation passages to the detection zone.

587. (Currently Amended) The electrophoresis apparatus of claim 585 ~~wherein the exit outlet passage flows into a container having an electrolyte solution and~~ further comprising a grounding electrode at an outlet end of the exit outlet passage.

588. (Currently Amended) The electrophoresis apparatus of claim 587 wherein the ~~container functions as a waste container or as a fraction collector reservoir where purified samples can be collected for chemical, biochemical or immunological tests~~ exit outlet passage flows into a container in which the grounding electrode is positioned.

589. (Currently Amended) The electrophoresis apparatus of claim 551 ~~wherein~~ further comprising passage bulging members which retain the first immobilized affinity ligands in the first analyte concentrator-microreactor.

590. (Previously Presented) The electrophoresis apparatus of claim 551 wherein the inner diameter of the transport passage is larger than the inner diameter of the first separation passage and than the inner diameter of the second separation passage.

591. (Previously Presented) The electrophoresis apparatus of claim 551 wherein the transport passage and the first and second separation passages are all capillaries.

592. (Previously Presented) The electrophoresis apparatus of claim 551 wherein the transport passage and the first and second separation passages are all channels.

593. (Previously Presented) The electrophoresis apparatus of claim 551 wherein the electrophoresis apparatus is a capillary electrophoresis apparatus.

594. (Previously Presented) The electrophoresis apparatus of claim 551 wherein the electrophoresis apparatus is a microchip electrophoresis apparatus.

595. (Previously Presented) The electrophoresis apparatus of claim 551 wherein first immobilized affinity ligands of the first analyte concentrator-microreactor are covalently linked to an inner wall of the first elongated portion.

596. (Previously Presented) The electrophoresis apparatus of claim 551 wherein the valve system includes transport passage valves and separation passage valves, and wherein the transport passage valves are adapted to be opened and the first separation passage valves are adapted to be closed to allow fluid to pass through the first concentrator-microreactor towards an outlet end of the transport passage.

597. (Previously Presented) The electrophoresis apparatus of claim 596 wherein the fluid is the sample, at least one chromophoric substance, and at least one cleaning buffer.

598. (Previously Presented) The electrophoresis apparatus of claim 551 wherein the valve system includes transport passage valves and first separation passage valves, and wherein the transport passage valves are adapted to be closed and the first separation passage valves are adapted to be opened to allow a separation buffer solution to pass through the first analyte concentrator-microreactor and in the first separation passage to the detector system.

599. (Currently Amended) The electrophoresis apparatus of claim 551 wherein one of the anode or cathode sides of the electrophoresis apparatus is generally at the buffer supply and the other side of the sides is downstream of the analyte concentrator-microreactors.

600. (Currently Amended) The electrophoresis apparatus of claim 551 wherein an inlet end of the separation passage is alternatively in fluid communication with ~~a sample supply or a separation buffer supply or an eluting buffer supply or~~ a cleaning solution supply or an eluting buffer supply or a separation buffer supply.

601. (Previously Presented) The electrophoresis apparatus of claim 551 wherein the passages are fused-silica or plastic tubes or channels.

602. (Previously Presented) The electrophoresis apparatus of claim 551 wherein the buffer supply of the first separation passage includes a separation buffer and an eluting buffer to release the bound first analyte of interest from first immobilized affinity ligands of the first analyte concentrator-microreactor.

603. (Previously Presented) The electrophoresis apparatus of claim 551 wherein the first separation passage is positioned and capable of separating therein the first analyte of interest retained by the first immobilized affinity ligands after the first analyte of interest is released from the first immobilized affinity ligands and of separating the released analyte by at least one mode of capillary electrophoresis.

604. (Currently Amended) The electrophoresis apparatus of claim 551 further comprising a buffer supply positioned upstream of the first intersection and an analyte concentrator containing non-specific affinity ligands and positioned upstream of the first ~~intersection~~ location.

605. (Currently Amended) The electrophoresis apparatus of claim 551 further comprising a buffer supply positioned upstream of the first intersection and an analyte concentrator containing highly-specific affinity ligands and positioned upstream of the first ~~intersection~~ location.

606. (Currently Amended) The electrophoresis apparatus of claim 551 wherein ~~the transport passage transports one or more chromophoric or tagging substances into the first and second analyte concentrator-microreactors after the~~ analytes of interest ~~are captured by the first and second immobilized affinity ligands, and the valve controlling means allows an elution buffer to then be introduced in inlet ends of the first and second separation passages and through the first and second analyte concentrator-microreactors~~ at least one of the separation passages transports analytes tagged with a chromophoric agent to the detector system.

607. (Previously Presented) The electrophoresis apparatus of claim 430 further comprising a buffer supply positioned upstream of the first intersection and an analyte

concentrator containing highly-specific affinity ligands and positioned upstream of the first intersection.

608. (Previously Presented) The electrophoresis apparatus of claim 493 further comprising a buffer supply positioned upstream of the first intersection and an analyte concentrator containing highly-specific affinity ligands and positioned upstream of the first intersection.

609. (New) An electrophoresis apparatus, comprising:

a transport passage;

a first separation passage overlapping and intersecting the transport passage at a first intersection;

the first intersection having a first staggered configuration which includes a first elongated concentration area;

a first analyte concentrator containing at least one first immobilized affinity ligand in the first elongated concentration area to concentrate a first analyte of interest from a sample introduced into the transport passage;

a second separation passage overlapping and intersecting the transport passage at a second intersection spaced downstream from the first intersection;

the second intersection having a second staggered configuration which includes a second elongated concentration area;

a second analyte concentrator containing at least one second immobilized affinity ligand in the second elongated concentration area to concentrate a second analyte of interest from the sample introduced into the transport passage;

analyte detector means for identifying and characterizing the first and second analytes of interest conveyed thereto from the first and second analyte concentrators, respectively; and

a valve system which controls flow of the sample in the transport passage and past the first and second intersections and which controls flow of buffer fluid through the first and second separation passages and conveyed by electrophoresis migration,

pressure or a combination of electrophoresis migration and pressure to the analyte detector means.